What is claimed is:

1. A method of analyzing tissue, the method comprising:

illuminating a tissue with coherent light;

receiving light reflected from the tissue at a detector to form a series of speckle patterns; and

analyzing changes in the speckle patterns at time intervals sufficient to measure changes caused by Brownian motion of objects within the tissue.

2. The method of claim 1, further comprising compensating for extrinsic motion to isolate the Brownian motion.

3. The method of claim 1, wherein the tissue is *in vivo*.

4. The method of claim 1, wherein the tissue is internal tissue.

5. The method of claim 4, wherein the illuminating step comprises providing an invasive device coupled to a light source, passing the device into a patient, placing the device in proximity to the tissue, and shining coherent light from the light source onto the tissue.

6. The method of claim 5, wherein the invasive device is selected from the group consisting of a catheter, an endoscope, and a laparoscope.

7. The method of claim 5, wherein the placing step includes placing the device in direct contact with the tissue.

8. The method of claim 5, wherein the invasive device comprises a catheter having a first fiber that transmits light from the light source to the tissue, and a fiber array that receives light remitted from the tissue.

9. The method of claim 1, wherein the coherent light comprises laser light.

10. The method of claim 1, wherein the speckle pattern is a far field image formed at the detector.

11. The method of claim 1, wherein the analyzing step comprises comparing each of the series of speckle patterns to a reference speckle pattern, and quantifying the differences between each pattern and the reference pattern.

12. The method of claim 11, wherein the analyzing step comprises digitizing each of the speckle patterns, and the quantifying step comprises evaluating a maximum cross-correlation between each pattern and the reference pattern.

13. The method of claim 12, wherein the analyzing step further comprises determining a decorrelation rate for the speckle patterns.

14. The method of claim 1, wherein the analyzing step further comprises analyzing spatial characteristics of the speckle pattern to deduce structural characteristics of the tissue.

15. The method of claim 14, wherein the illuminating step comprises illuminating multiple sections of the tissue in succession, the receiving step comprises forming a separate series of speckle patterns for each respective section of the tissue, and the analyzing step comprises analyzing each separate series of speckle patterns and comparing the separate series to deduce structural differences between the respective sections of the tissue.

16. The method of claim 2, wherein compensating for extrinsic motion comprises performing the receiving step during a diastole of a heartbeat.

17. The method of claim 2, wherein the receiving step comprises gathering reflected light at a light receptor and transmitting the gathered light to the detector, and wherein compensating for extrinsic motion includes coupling the receptor to the tissue.

18. The method of claim 2, wherein compensating for extrinsic motion includes excluding changes in the speckle patterns caused by non-random motion during the analysis step.

19. The method of claim 2, wherein extrinsic motion results from blood flow between the tissue and the reflector, and the compensating step comprises replacing the blood with a transparent solution.

20. The method of claim 1, wherein the tissue comprises atherosclerotic plaque.

21. A method of determining the susceptibility to rupture of an atherosclerotic plaque having a lipid pool and a fibrous cap, the method comprising:

illuminating the plaque with coherent light;

receiving light reflected from the plaque at a detector to form a series of speckle patterns;

gathering speckle pattern data at time intervals sufficient to measure Brownian motion within the lipid pool; and

assessing the plaque's vulnerability to rupture from the amount of Brownian motion.

22. The method of claim 21, further comprising analyzing spatial characteristics of the speckle pattern data to determine structural characteristics of the plaque.

23. The method of claim 22, wherein the analyzing step comprises assessing the thickness of the fibrous cap.

24. The method of claim 23, wherein a plaque is considered vulnerable to rupture if the thickness of the fibrous cap is less than about 60 microns.

25. The method of claim 22, wherein the analyzing step comprises assessing the viscosity of the lipid pool.

26. The method of claim 25, wherein the plaque is considered vulnerable to rupture if the viscosity of the lipid pool has a time constant of less than about 200 milliseconds.

27. The method of claim 25, wherein the plaque is considered likely to rupture if the viscosity of the lipid pool has a time constant of less than about 100 milliseconds.

28. A method of detecting a vulnerable atherosclerotic plaque having a lipid pool and a fibrous cap within a blood vessel, the method comprising:

illuminating a segment of the blood vessel *in vivo* with coherent light;

receiving light reflected from the interior vessel wall of the segment at a detector to form a series of speckle patterns;

gathering speckle pattern data at time intervals sufficient to measure Brownian motion within the interior vessel wall; and

comparing the speckle pattern data to a known speckle pattern for a normal blood vessel and a known speckle pattern for an atherosclerotic plaque;

wherein speckle pattern data corresponding to a speckle pattern for an atherosclerotic plaque indicates the segment of the blood vessel contains an atherosclerotic plaque.

29. The method of claim 28, further comprising analyzing spatial characteristics of the speckle pattern data to determine structural characteristics of the plaque.

30. The method of claim 29, wherein the analyzing step comprises assessing the thickness of the fibrous cap.

31. The method of claim 30, wherein a plaque is considered vulnerable to rupture if the thickness of the fibrous cap is less than about 60 microns.

32. The method of claim 29, wherein the analyzing step comprises assessing the viscosity of the lipid pool.

33. The method of claim 32, wherein the plaque is considered vulnerable to rupture if the viscosity of the lipid pool has a time constant of less than about 200 milliseconds.

34. The method of claim 32, wherein the plaque is considered likely to rupture if the viscosity of the lipid pool has a time constant of less than about 100 milliseconds.

35. A fiber optic probe for detecting speckle patterns in a sample, the probe comprising

a catheter including a rotatable inner shaft and a transparent outer sheath;

a fiber array housed within the shaft and comprising a central optical fiber for transmitting incident light to the sample and multiple optical fibers for transmitting light remitted from the sample; and

a mirror arranged near a distal end of the shaft to reflect light passing through the fiber array onto a sample outside the transparent outer sheath and back from the sample through the fiber array.

36. The fiber optic probe of claim 35, wherein the shaft can rotate 360 degrees within the sheath.

37. The fiber optic probe of claim 35, further comprising an inflatable balloon connected to the sheath.

38. An optical system for detecting speckle patterns in a sample, the system comprising

a fiber optic probe of claim 35;

a coherent light source connected to the central optical fiber within the fiber array;

a detector to receive light remitted from the sample; and

a processor to process the remitted light and to analyze speckle patterns remitted from the sample.

39. The system of claim 38, wherein the processor comprises a reference speckle pattern.

40. The system of claim 38, wherein the processor comprises an analog-digital converter to convert the analog remitted light into a digital signal.